Contrasted with other regions, the richness of Shetland in cup-, apple-, and turnip-sponges, its swarms of *Arachnactis albida* and *Echinus norvegicus*, the occurrence of *Cidaris papillata*, the huge *Cucumaria frondosa*, *Eurythoë borealis*, *Lætmatonice*, the Ampharetidæ, the peculiar mollusca, the large size and frequency of the torsk, the presence of *Chimæra* and its many Cetaceans, give it characters of its own. The majority of these appear to have come from the north and east. Forms, again, which occur in deep water in Shetland appear between tide-marks in the Channel Islands, and occasionally in diminished bulk. The presence of Mediterranean forms—*Xantho rivulosus*, *Pagurus tuberculatus*, and *Pinna rudis*—show how difficult it is to explain the centres of origin or the lines of migration.

Boldly mapping out the warmer southern area is the distribution of *Noctiluca*, of the silky-spined urchins, the brightly coloured *Eurylepta*, and *Drepanophorus* amongst Nemerteans, of the southern sea-mouse (*Hermione*), of the crustaceans *Alpheus*, the spiny lobster, *Polybius* and *Dromia*, the mollusks *Gastrochæna*, *Galeomma*, *Mactra glauca*, *Haliotis*, and the frequency of the cuttles between tide-marks, of *Balanoglossus*, the finely coloured wrasses, the red mullets, and the pilchards. Almost all these forms are essentially southern, and they show no stragglers leading northwards, such having probably been checked more by the diminished annual temperature than by the absence of favourable currents.

In conclusion, limited as the area we have been considering is, it is apparent that while some forms are common to all, certain restraining influences check the spread of others, so that they become more or less characteristic of the several regions. Moreover, the mixed nature of the fauna shows that we have to do with several sources of origin, some of which date back to geological periods marked by a different arrangement of the land, and a consequent change in the temperature of the water.

LX.—*On Excretory Organs and Sexual Conditions in certain Isopoda.* By Bohumil Němec, of Prague *.

In the course of my investigations upon Isopods I have arrived at certain interesting results relating to their excretory and genital organs, of which I here furnish a short *résumé*.

* Translated by E. E. Austen from the 'Zoologischer Anzeiger,' Bd. xix. no. 507 (July 6, 1896), pp. 297–301.

The excretory organs characteristic of the majority of Crustacea, namely the antennary and shell-glands, are found in the Oniscodeæ, which formed the greater part of my material for investigation, either greatly reduced or with altered functions, as has already been pointed out by Claus in the case of the Anisopoda.

The antennary gland forms a small glandular saccule at the base of the antennæ, which, however, is destitute of any efferent duct. In *Asellus* and *Ligidium* this saccule is of fairly large size and also possesses a distinct lumen. In the Oniscineæ, on the other hand, the homologous rudiment forms only a small solid mass of cells. Probably the saccule alluded to corresponds to the so-called terminal saccule ("Endsäckchen"), as it appears in homologous normally developed glands.

The shell-gland, which was found by Claus in *Asellus* and certain Oniscineæ, exhibits various conditions in Isopods. In *Asellus*, as stated by Claus, and as I was able to convince myself, it is enormously developed. In this case also it really represents an excretory organ. In Oniscodeæ this gland is either reduced, as is especially the case in the Oniscineæ, or it has—in Hygrophileæ—experienced a change of function.

In *Ligidium*, *Haplophthalmus*, and *Trichoniscus* this gland appears as an organ of somewhat considerable size, which extends beneath the masticatory stomach right into the basal joints of the second pair of maxillæ and of the maxillipedes. In front there can be distinguished a thin-walled terminal saccule, leading into a long coiled canal which opens on the underside of the second pair of maxillæ. The epithelium of the coiled canal possesses a typical cortical striation, which is coarsely developed, particularly in *Haplophthalmus*. Exactly below the orifice the maxillipede exhibits a spoon-shaped excavation, and it is in this very cavity that the discharged secretion is collected. Sagittal longitudinal sections show quite clearly that the secretion which fills the cavity really comes from the shell-gland.

This collection of the evacuated secretion must surely have an object. Probably the secretion comes in some way into play in the process of feeding. This explanation is the more probable since otherwise no differentiated salivary glands occur in Oniscodeæ, and, moreover, in the case of other Articulata excretory organs may enter into close relationship to the ingestion of food.

The very organ that functions as a salivary gland in the Hygrophileæ referred to appears greatly reduced in the

Oniscineæ (*Porcellio*, *Platyarthrus*). In *Platyarthrus* it appears to be altogether devoid of an excretory duct. A distinct terminal saccule can with difficulty be made out. The gland, which is greatly pressed towards the ventral side, consists of a curved and relatively simple sac, of which the epithelial wall—just as in the Hygrophileæ—represents a syncitium. In the plasma two well-marked layers can be distinguished. The lower one, in which also lie the nuclei, is finely granular; that which clothes the lumen is clear and finely striated.

Besides urinary deposits in the fat-body, as has been described by Weber in *Trichoniscus*, we find in Oniscodeæ peculiar excretory organs lying in the last three thoracic and in the three to five abdominal segments. In the fourth segment there lies to the side of the abdominal ganglion a large gland, which opens upon the fifth segment (really almost intersegmentally between the fourth and fifth segments). This glandular sac, which in forms provided with pigment is surrounded by a pigmented sheath of connective tissue, is formed for the most part of large cells, and its broad lumen is filled with a finely granular secretion. The organ appears to be of ectodermal origin.

The glands of the two following segments are thin-walled sacs lying in the region of the lateral blood-lacunæ, and their epithelium consists of well-differentiated cells. The lumen of these glands is filled with a secretion similar to that of the gland of the fourth segment. In respect of these organs the Hygrophileæ differ from the Oniscineæ in that in the former the two pairs of glands alluded to lie freely in the connective tissue, without efferent ducts and surrounded by lateral blood-lacunæ. In Oniscineæ a fine efferent duct runs from the usually irregularly lobed glands, and opens beneath the epimerite in front of the legs of the sixth and seventh segments. In Hygrophileæ, however, the glands take the shape of closed sacs, the interior of which is entirely filled with a homogeneous yellowish secretion. The phylogeny of these organs appears to me to be determined by the conditions found in *Haplophthalmus*, where, besides the large segmental sacs, we meet with small saccules precisely similar to the large ones and lying irregularly distributed in the connective tissue in the region of the blood-lacunæ.

This appears to me to be the original condition of the organs in question. In the connective tissue were deposited—as happens in an intracellular manner in the pericardial tissue—intercellular urinary substances, certain of which developed into large sacs, which finally were enabled to discharge their

secretion to the exterior by means of an excretory duct of secondary origin.

In the first three abdominal segments (*Porcellio*)—in *Ligidium*, in all probability in the two following ones also—I found coiled and ramifying canals, which send out efferent ducts towards the bases of the several branchial opercula. The canals in question again are situated in the region of those blood-lacunæ in which the blood from the branchiæ streams up into the pericardium. If these tubes really function as excretory organs their difference in form and structure from the excretory organs of the last thoracic segments may be explained by the fact that in this case it is oxydized blood that is dealt with, while, on the other hand, the former excretory organs are washed by venous blood.

In the case of *Asellus* urinary deposits in the fat-body have already been recognized by Leydig in what are known as Zenker's glands. These glands are distinguishable with the naked eye as being composed of separate globules, each of which represents a single cell, and these cells may attain a size of as much as 8 millim. Their plasma is entirely obliterated by spherical concretions. But these cells still exhibit a large nucleus, provided with nuclear reticulum and chromatin granules, which appears to be for the most part pressed flat and much emarginated. Consequently we are here dealing not with a mechanical deposition of secreted substances, but with a vital energetic activity of certain specified cells of the connective tissue.

I shall publish elsewhere a detailed description of the sexual organs of Isopods. I will here only allude to certain phenomena which are correlated with hermaphroditism.

The oviducts in Oniscodeæ open, as is well known, upon the fifth segment. The distal portion of the oviduct secretes the receptacula seminis, discovered by Schöbl, as hollow chitinous structures or as solid styles. It is manifest that this portion is of ectodermal origin, as is also proved by its embryology. Now, I found in males of *Platyarthrus* in the fifth thoracic segment the same structure which in immature females represents the rudiment of the distal section of the oviduct. This consists of a blind tube projecting into the body-cavity, which in young males is filled with a solid style of chitin, but in older ones with a hollow blind chitinous cylinder that is undoubtedly homologous with the female receptaculum. We must regard this as an hermaphrodite structure. As regards internal sexual organs I searched in vain for phenomena which could be connected with the condition in question. On the other hand, I directed my

attention to rudimentary appendages upon the first two abdominal segments in the female, which Schöbl had already designated rudimentary male copulatory organs, an interpretation with which I entirely concur.

It is a well-known fact that a remarkable sexual difference occurs in Isopods with reference to the size of the adults. In *Platyarthrus* the males appear considerably smaller than the females. They exhibit on the whole characters belonging to immature females, and this applies especially to the size of the brain; for in both sexes up to a certain stage the brain grows at the same rate. Adult males have a brain of precisely the same size as that of immature females of about the same dimensions. The female continues to grow, but the brain undergoes no further increase in size, so that it finally comes to lie in a large cephalic cavity; while in the males, on the contrary, the cephalic cavity is entirely filled by the brain. It would be quite a plausible view to suppose that at one time all individuals attained to male sexual maturity at a stage at which they had not yet reached their definitive size. After fulfilling their sexual function as males they continued to grow and developed into sexually mature females. In the stage of male sexual maturity the brain was very large; it still entirely filled the cephalic cavity, while the oviducts were present only in the form of blind invaginations of the hypodermis, as is yet the case in sexually mature males at the present time.

A successive hermaphroditism of this kind, however, proved to be not advantageous, and in consequence of this there ensued a separation of the sexes. Certain individuals remained stationary at the stage of male sexual maturity, in consequence of which they remind us of immature individuals: the rudiments of the oviducts, too, have persisted in them. Other individuals grew on directly into females, since in these there has been a cænogenetic cessation of the appearance of male sexual organs. As remnants of a male maturity which formerly appeared in them these individuals possess rudiments of male copulatory organs.

In *Platyarthrus* accordingly proterandrous hermaphroditism at one time occurred. In other Isopods it may perhaps have been proterogynous. This was the case in *Sphæroma rugicauda*, for instance, in the internal sexual organs of which Leichmann discovered what were undoubtedly hermaphrodite rudiments. This author observes also that all young specimens exhibit the general appearance of females, which in the case of certain individuals is not exchanged for the definitive masculine form until shortly before the attainment of male

sexual maturity. He also describes an individual which, though internally it exhibited fully developed male sexual organs, as far as its exterior was concerned bore quite the character of a female, even possessing, indeed, rudiments of brood-lamellæ.

I incline towards the view that Isopods were originally altogether hermaphrodite. Such conditions, however, persisted only in parasitic forms (Cymothoidæ), for which hermaphroditism must be universally advantageous. In the case of free-living forms this state of affairs disappeared. In them we find that only scattered and scanty hermaphrodite remnants or rudiments are preserved.

LXI.—*A new Genus of Aglossal Batrachians.*

By G. A. Boulenger, F.R.S.

Among the rich herpetological collections made by Stuhlmann in East Africa the frog described by Tornier as *Xenopus Boettgeri* (Thierw. Ost-Afr., Rept. Amph. p. 163, fig., 1896) is of exceptional interest in adding a second genus to the Dactylethridæ. As Tornier has not realized the systematic importance of the characters which differentiate the new species from *Xenopus lævis* and its allies, it is thought desirable to emphasize it by raising *Xenopus Boettgeri* to generic rank under the name of *Hymenochirus Boettgeri*. The principal characters that distinguish *Hymenochirus* from *Xenopus* are, so far as can be judged from Tornier's description and figure, the half-webbed fingers, the incompletely webbed toes, the third of which considerably exceeds the fourth in length, and, above all, the absence of lines of sensory muciferous canals on the body. No doubt a careful examination of the type specimen, unfortunately still unique, would reveal further differences, and the Röntgen rays might be usefully applied to obtain some information on the osteological characters.

LXII.—*Descriptions of Two new Frogs obtained in Madagascar by Dr. Forsyth Major.*

By G. A. Boulenger, F.R.S.

Mantidactylus Majori.

Closely allied to *M. curtus*, Blgr., but snout much longer, acutely pointed, and very strongly projecting beyond the mouth. Vomerine teeth in two small, oblique, oval groups close together behind the level of the choanæ. Head longer